International Journal of Research in Agricultural Sciences
Volume 8, Issue 3, ISSN (Online): 2348 – 3997

Phytoecological Study on Asteraceae Family of Trebeshina Mt. in Southern Albania

Dhimiter Peci [1*], Alfred Mullaj [1] and Arsen Proko [2]
[1] Research Center of Flora and Fauna, Faculty of Natural Sciences, Tirana University, Albania.
[2] Faculty of Forestry, Agricultural University of Tirana, Albania.
*Corresponding author email id: dhimiter.peci@fshn.edu.al

Date of publication (dd/mm/yyyy): 10/06/2021

***Abstract* – The study aims the investigation of floristic diversity of species of Asteraceae family in Trebeshina Mt. and the estimation of their ecological optima. This mountain is located in Southern Albania and it belongs to a very important Albanian Mountain Range Trebeshine-Dhembel-Nemercke. A checklist of 40 Asteraceae species from 24 genera, were identified and presented with an analysis of their flora elements. The results provides in addition an important insight in regard of the endemic (10%), medicinal (27.5%) and endangered (12.5%) Asteraceae species richness in this area, which will directly contribute to the future conservation practices. Here in, we provide the first dataset of Ellenberg ecological optima of Asteraceae species of the Trebeshina Mt considering seven factors, light, temperature, continentality, soil reaction, moisture, and nutrient.**

***Keywords* – Trebeshina Mt., Asteraceae, Flora, Ellenberg Indicator Values, Albania.**

I. INTRODUCTION

The Asteraceae is one of the largest vascular plants families in native Albanian flora, it comprises 96 genera and 420 species (Vangjeli J., 2015). The considerable species richness is due to the country's geographical, ecological and climatic conditions range. Asteraceae species are reported to have almost all life forms (Funk et al., 2005), but herbaceous form predominate in Albania. The Trebeshina Mountain is located in Southern of Albania and is part of Mount Range Trebeshine-Dhembel-Nemercke, which is considered as a biodiversity hotspot area. The Trebeshina Mt. covers an area of about 35.06 km^2 and is located between latitudes 40° 17' 55.9" and 40° 25' 09.75"N and longitudes E 20° 10' 09.73 and 20° 06' 28.55" E. The area has a Mediterranean climate, in geological terms this mountain is composed of a variety of formations such as calcareous greyish – brown and silt. A few floristic data on Trebeshina Mt. are previously described by Peci et al. (2020), but there are no data regarding the flora of Asteraceae family in this area. To date studies on Albanian flora have had limited focus the ecology of Asteraceae species. Ellenberg's indicator values (EIVs) have been considered a useful tool to estimate the impact of environmental factors in flora and vegetation changes in an area (Ellenberg at al., 1992). These indicators were firstly developed by Ellenberg (1974, 1979, 1991, 1992), this system has been applied and modified to adapt to specific characteristics of different countries (Pignati et al., 2005; Berg et al., 2017; Chytrý et al., 2018; Domina et al., 2018). The main aim of the present work is to investigate the phytoecological diversity of Asteraceae family in Trebeshina Mt. providing the first checklist of its species and the ecological niches of these species using of Ellenberg's indicator values.

II. MATERIAL AND METHODS

The studied area is located in the South of Albania, Trebeshina Mountain is part of the Trebeshine-Dhembel-Nemercke mount range. Its elevation ranges from 170-1923 m a.s.l. The common geological formation is calcareous, silty near Dishnica, tributary of Vjosa River and grayish brown. The study was carried out over the course of two years. We used 5x5m quadrat plots for sampling. Our research focused on the analysis of the flora

of Asteraceae family found in Trebeshina Mt. The plant specimens were identified according to Vangjeli J. (2015). Following the identification and registration of plant species of this family the evaluation of floristic elements, life cycle, flowering period and IUCN criteria were evaluated. Voucher specimens of each species are kept at the National Herbarium of Albania.

The life cycle was determined based on the Flora of Albania (Vangjeli J., 2015). Ellenberg indicators were assessed according to the Ellenberg et al. (1992; 1996) criteria and scales. Indicators considered were light (L), nitrogen (N), reaction of the soil (R), continentally (C) and temperature (T) on scales ranging from 1 to 9, and the moisture (F) on a scale ranging from 1 to 12.

III. Results and Discussion

A list of forty Asteraceae family plant taxa found on Trebeshina Mt. was compiled during field surveys in two years (Table 1). Herbaceous species were found in higher frequency. The majority of species had perennial life cycle (75%), followed by biennial (12.5%) life cycle, while the others were classified to an annual (5%), annual-biennial (5%) and annual-perennial (2.5%) (Figure 1).

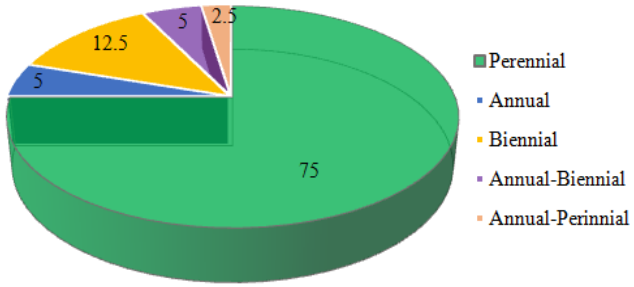

Fig. 1. The percentage of life cycle of Asteraceae family.

The subendemic species of Asteraceae family found in this study were *Carduus micropterus; Carduus tmoleus; Centaurea zuccariniana and Cirsium tymphaeum.* The majority of species of this family found in the studied area are not in the Red List of Albania, because the lack of data on their status. The vulnerability of plant taxa was based on IUCN criteria, five species (12.5%) were classified as endangered (EN) *Carduus micropterus, Carduus tmoleus, Cirsium tymphaeum, Helycrisum plicatum* and vulnerable (VU) *Centaurea zuccariniana* (Table 1)

Table 1. List of species, their life forms and chorological elements and bloom phase of Asteraceae family found in Trebeshina Mt.

No	Botanical Name	IUCN Category	Flowering
1	*Achillea chrysocoma*	NE	Jun-Jul
2	*Achillea millefolium*	NE	May-Jul
3	*Anthemis arvensis*	NE	May-Oct
4	*Anthemis cotula*	NE	Jun-Oct
5	*Anthemis tinctoria*	NE	May-Aug
6	*Anthemis chia*	NE	Jun-Jul
7	*Artemisia campestris*	NE	Jul-Sept.
8	*Bellis perennis*	NE	Nov-Jun

No	Botanical Name	IUCN Category	Flowering
9	*Carduus micropterus*	EN	Jun-Aug
10	*Carduus tmoleus*	EN	Jun-Aug
11	*Carlina vulgaris*	NE	Jun-Sept
12	*Carlina acanthifolia*	NE	Jun-Sept
13	*Centaurea solstitialis*	NE	Jun-Aug
14	*Centaurea alba*	NE	Jun-Aug
15	*Centaurea scabiosa*	NE	Jun-Aug
16	*Centaurea triumfettii*	NE	May-Aug
17	*Centaurea zuccariniana*	VU	Jun-Aug
18	*Cicerbita alpina*	NE	Jun-Aug
19	*Cirsium appendiculatum*	NE	Jul-Aug
20	*Cirsium tymphaeum*	EN	Jun-Aug
21	*Cirsium vulgare*	NE	Jul-Oct
22	*Doronicum columnae*	NE	May-Aug
23	*Helycrisum plicatum*	EN	Jun-Aug
24	*Hieracium pilosella*	NE	Jun-Oct
25	*Hieracium piloselloides*	NE	May-Aug
26	*Inula oculus-christi*	NE	Jun-Aug
27	*Inula salicina*	NE	Jun-Sept
28	*Lactuca perennis*	NE	Apr-Jul
29	*Leontodon hispidus*	NE	May-Oct
30	*Mycelis muralis*	NE	Jun-Aug
31	*Prenanthes purpurea*	NE	Jun-Aug
32	*Senecio thapsoides*	NE	Jun-Aug
33	*Senecio scopolii*	NE	Apr-Jun
34	*Serratula tinctoria*	NE	Aug-Oct
35	*Silybum marianum*	NE	Jun-Aug
36	*Sonchus oleraceus*	NE	Mar-Oct
37	*Tanacetum parthenium*	NE	Jun-Jul
38	*Tanacetum corymbosum*	NE	Jun-Jul
39	*Tragapogon pratensis*	NE	May-Aug
40	*Tussilago farfara*	NE	Jan-Mar

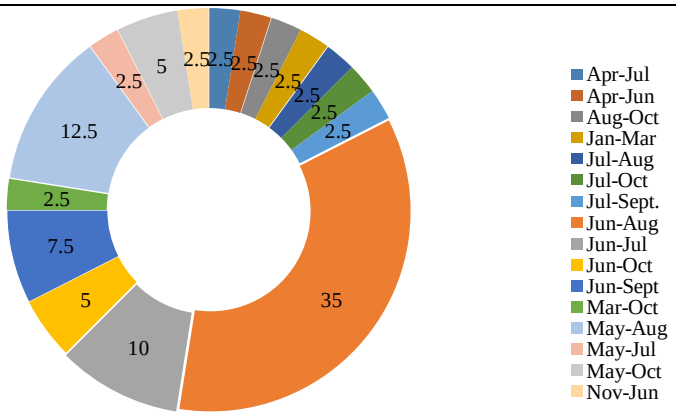

Fig. 2. Flowering period of Asteraceae family.

There were 16 flowering periods identified in Asteraceae species, with the majority species (35%) blooming in between June and August, 12.5% blooming on the period May-August and 10% on the period June-July. Other species (from 2.5-7.5%) bloom at other periods as shown in the figure 4. The flowering period is an important indicator of climate, it has been linked to different elevations these plants' habitats. These data will be useful in future conservation programs for these species, especially those classified as endangered.

Many species of Asteraceae family are well known for their medicinal properties and their essential oils antimicrobial (Simic et al. 2000; Saeindnia et al., 2011) and anti-inflammatory activity (Saeindnia et al., 2011; Jafarinia & Jafarinia, 2019). They are well known to play an important role in the treatment of several diseases from diabetes to various types of cancers (Koc et al., 2014) and on immune-mediated diseases (Jafarinia & Jafarinia, 2019).

Considering the species of this family found in Trebeshina Mt. 27.5 % of them are medicinal plants such as *Achillea chrysocoma*, *Achillea millefolium*, *Artemisia campestris*, *Bellis perennis*, *Carlina vulgaris*, *Carlina acanthifolia*, *Helycrisum plicatum*, *Hieracium pilosella*, *Silybum marianum*, *Sonchus oleraceus*, *Tussilago farfara.*

Ellenberg's indicators are considered as an effective tool for the estimation of ecological conditions of plant species within a given flora. They can be especially useful in identifying ecological optima of plant species and assisting their conservation action plans. Average Ellenberg indicator values as bioindicators of abiotic environmental conditions for Asteraceae species in our study are presented in the table 3 and figure 4. Average EIVs for all species under study were as follow; light (L) = 7.1, with a range of 4-10; temperature (T) = 5.8 with a range of 3-9; continentality (C) = 4.8 with a range of 2-7; moisture (F) = 3.8 with a range of 2-6; soil reaction (R) = 6.7 with a range of 5-8; soil nutrients (N) = 5.2 with a range of 2-9. Ellenberg's indicator values with a wide range as shown in the table 3 and figure 4, were nutrient (N), moisture (F), continentality (C), temperature (T) and light (L) with standard deviation above 1. While less variable resulted the soil reaction (R) with Standard Deviation value of 0.88 (table 3; figure 4).

Table 2. Ellenberg Indicator Values for each of the Asteraceae sp. from Trebeshina Mt

Species	**(L)**	**(T)**	**(C)**	**(F)**	**(R)**	**(N)**	**(S)**
Bellis perennis	8	5	5	5	7	8	2
Cirsium vulgare	8	5	4	5	7	8	1

Species	(L)	(T)	(C)	(F)	(R)	(N)	(S)
Cirsium arvense	8	5	x	5	6	7	1
Carduus micropterus	8	6	5	4	8	6	0
Helycrisum plicatum	8	7	6	3	8	2	0
Centaurea zuccariniana	4	5	x	x	x	x	x
Tussilago farfara	8	5	4	6	7	6	0
Hieracium pilosella	10	6	6	3	5	7	1
Tanacetum corymbosum	6	7	5	4	7	4	0
Mycelis muralis	4	5	2	5	6	6	0
Inula salicina	7	6	7	4	7	6	2
Serratula tinctoria	6	6	5	6	7	3	1
Centaurea triumfettii	7	7	5	3	8	3	0
Doronicum columnae	6	4	4	4	7	9	1
Centaurea alba	4	6	4	5	7	6	1
Hieracium piloselloides	9	6	4	4	8	2	0
Carlina vulgaris	8	5	6	4	7	3	1
Centaurea scabiosa	7	6	5	2	7	7	1
Leontodon hispidus	7	5	7	5	6	6	0
Inula oculus-christi	9	8	x	2	8	3	0
Artemisia campestris	9	4	6	2	7	2	0
Senecio scopolii	10	4	4	2	7	3	0
Artemisia absinthium	8	6	7	4	7	7	1
Carlina acanthifolia	10	4	7	3	8	3	0
Tragapogon pratensis	4	7	5	5	7	6	0
Achillea millefolium	7	5	5	5	6	5	1
Senecio thapsoides	9	7	4	2	8	2	0
Tanacetum parthenium	7	6	6	5	7	7	1
Lactuca perennis	9	7	4	2	8	2	0
Cicerbita alpine	5	3	2	6	6	7	0
Prenanthes purpurea	4	4	4	5	5	6	0
Cirsium appendiculatum	5	7	4	5	7	7	0
Anthemis chia	7	9	5	2	x	2	0
Centaurea solstitialis	8	8	6	3	7	6	0
Anthemis arvensis	6	5	5	3	5	8	1

Species	(L)	(T)	(C)	(F)	(R)	(N)	(S)
Silybum marianum	7	7	x	4	7	7	1
Sonchus oleraceus	6	4	4	4	7	5	2
Anthemis cotula	6	4	5	5	7	5	3
Anthemis tinctoria	8	6	5	2	6	4	0
Carduus tmoleus	7	6	4	3	6	6	0

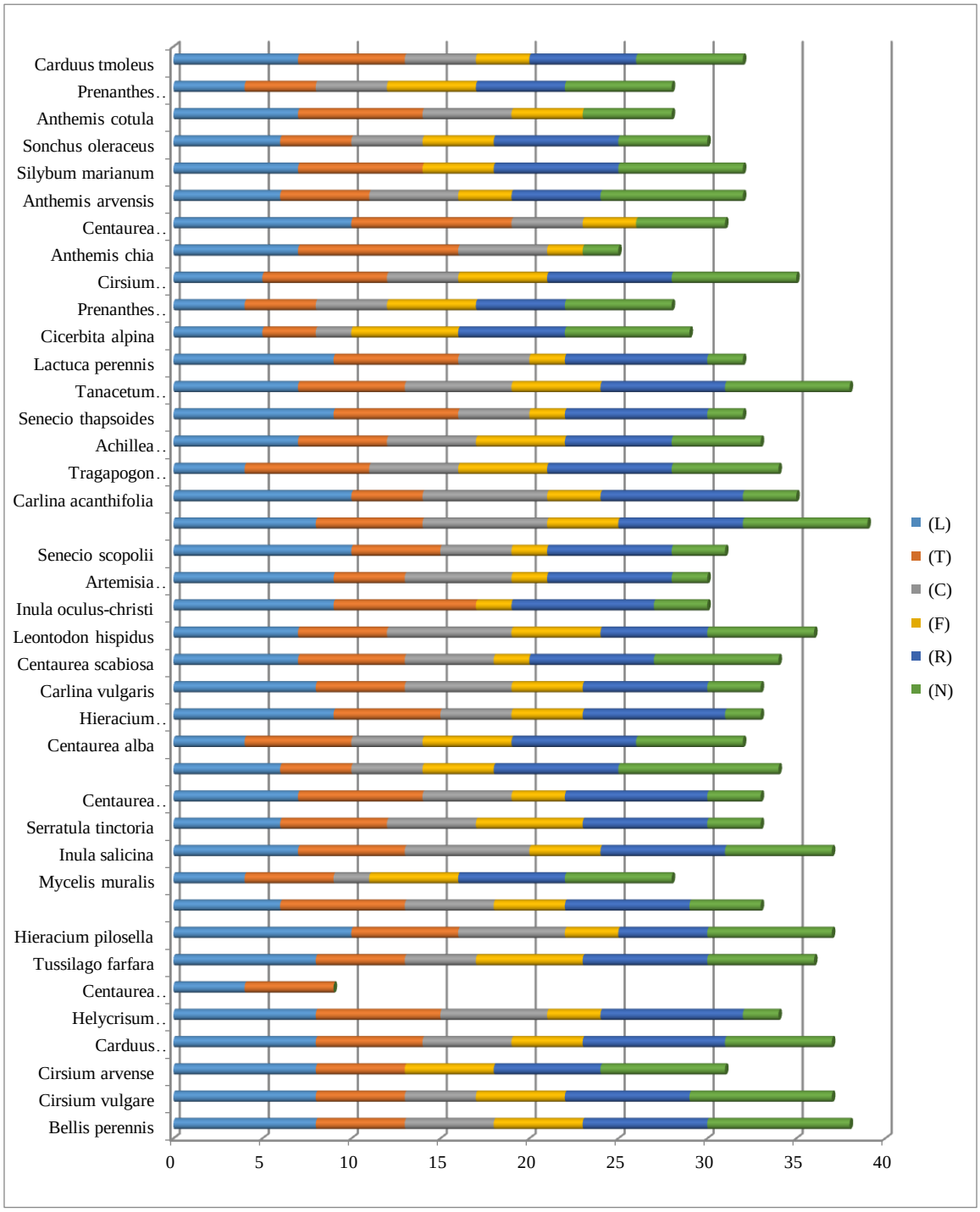

Fig. 3. Ellenberg indicators for each of Asteraceae species from Trebeshina Mt.: L-light; T-temperature; C-continentality; F-soil moisture; R-soil reaction and N-soil nutrients.

Table 3. Ellenberg values statistics for Asteraceae sp from Trebeshina Mt.

	(L)	(T)	(C)	(F)	(R)	(N)
Min	4	3	2	2	5	2
Max	10	9	7	6	8	9
Mean	7.1	5.8	4.8	3.8	6.7	5.1
Standard deviation	1.77	1.34	1.21	1.65	0.88	2.07
Variance	3.12	1.79	1.46	2.73	0.78	4.29

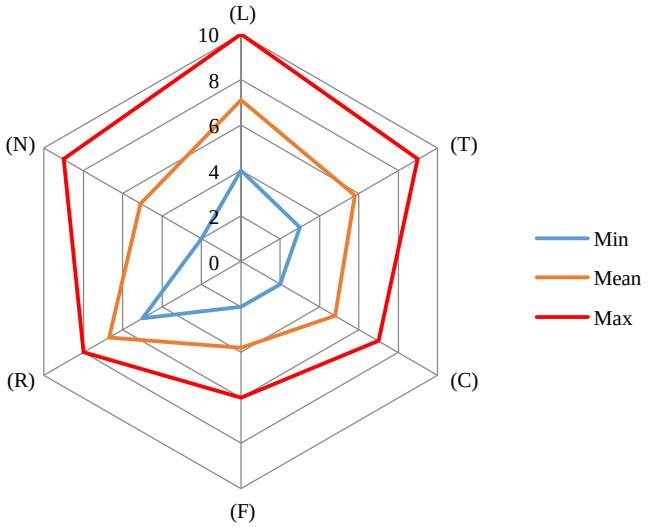

Fig. 4. Ecogram of Asteraceae species in Trebeshina Mt. from the means of seven ecological Ellenberg indicators: L-light; T-temperature; C-continentality; F-soil moisture; R-soil reaction and N-soil nutrients.

Ellenberg's indicator values were also estimated for each of the species of Asteraceae family from Trebeshina Mt. The dataset is presented in the table 2 and the ecogram constructed using this dataset is given in the figure 3. The identification of EIVs for each species is also important in the context of using the species as indicators of environmental conditions.

The optimal high/shade conditions for each species of Asteraceae family in Trebeshina Mt. was estimated in a ten-degree scale. High variation was observed for light (L) indicator, five species (*Centaurea alba, Centaurea zuccariniana, Prenanthes purpurea, Mycelis muralis, Tragapogon pratensis*) were grown in semi half shade (L = 4), the majority of species were grown in different levels of light and shade exposure (table 2, figure 3), while four species (*Hieracium pilosella, Senecio scopolii, Carlina acanthifolia, Centaurea solstitialis*) were grown in full light conditions.

Temperature indicator within studied species ranged from cool temperatures (T=3) characteristic of subalpine areas found in one species (*Cicerbita alpine*) to extreme temperatures (T=9) characteristic of warmest mountain sites comprised two species (*Anthemis chia, Centaurea solstitialis*), found in Southern slop face of Trebeshina. The most representative temperature indices were T=5, moderate temperature, characteristic low land to mountain belt and T=6 characteristic of low land and coline species each represented by 11 species (table 2).

Continentality is an important indicator that correlates with plant distribution; we estimated it on a nine-degree scale in our study. Its values ranged from strongly oceanic (C=2) in two species (*Mycelis muralis* and

Cicerbita alpine) to moderately continental (C=7) in four species (*Carlina acanthifolia, Inula salicina, Artemisia absinthium, Leontodon hispidus*), while other continentality indices as weakly oceanic (C=4), indifferent (C=5) and weakly continental (C=6) were found in thirteen, twelve and five species, respectively (table 2 and figure 3).

Moisture, which represents a species' water level niche, was estimated on a twelve degree scale. EIVs for this indicator revealed that the majority of the species fall into F=4 and F=5, indicating that this species prefers average moisture soils and they are missing on damp soils. Eight species, (*Artemisia campestris, Senecio scopolii, Centaurea scabiosa, Anthemis tinctoria, Senecio thapsoides, Lactuca perennis, Inula oculus-christi, Anthemis chia*), showed tolerance to drought (F=2), while three of them (*Cicerbita alpine, Tussilago farfara, Serratula tinctoria*) showed preference for higher moisture soils (F=6), characteristic of well moisture but not wet soils.

Some of Ellenberg indicators showed significant variation, nutrient (N) values ranged from moderately very poor (N=2) to naturally most rich soil (N=8) and only one species (*Doronicum columnae*) was found in an abundant supply of nutrients (N=9) nearby cattle resting area.

Considering Ellenberg's indicator values for each of species under study (table 2, figure 3) resulted that the majority of species (18) were grown in neutral conditions (R=7), while 10 species were mildly acidophytic (R=5; R=6), and eight of them showed to be calciphytic (R=8). However there were no observed high variations within species for this indicator (st.dev=0.88).

Mean of EIVs for species occurring at a given vegetation type such as such as Beech forests, Oak, Garrigue, Riparian, Subalpine and Alpine, Arable land and Uncultivated land vegetation were also calculated and graphically presented in the figure 5.

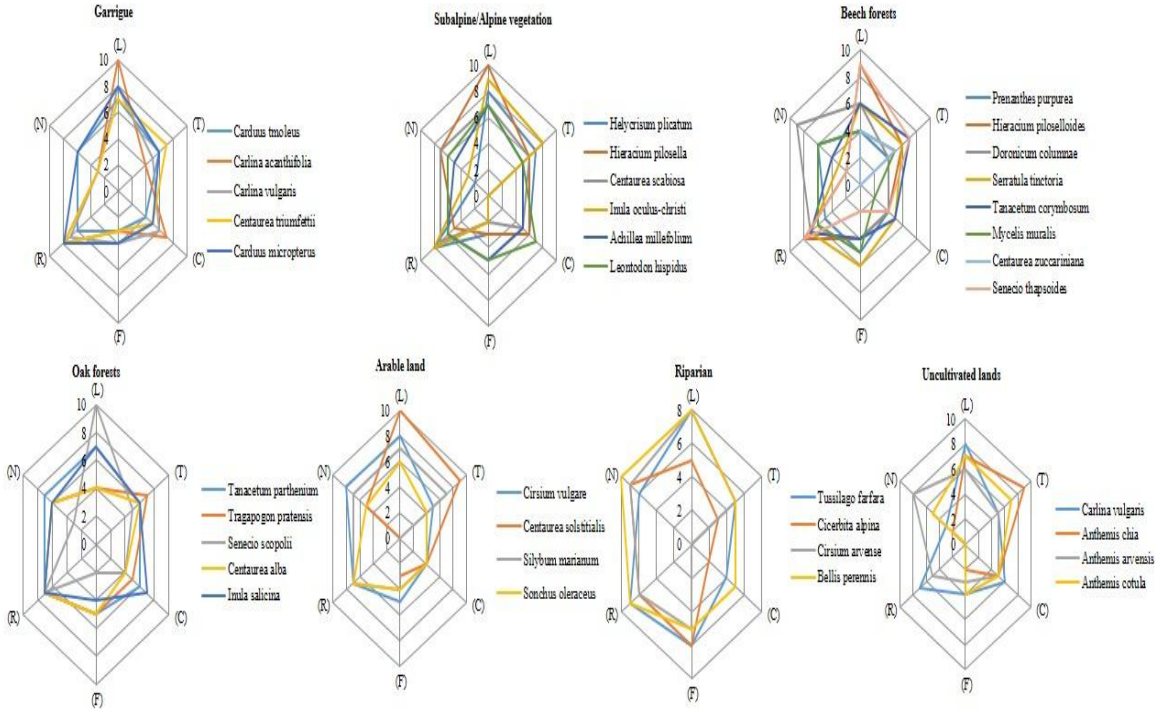

Fig. 5. Ecograms of Asteraceae species in various vegetation types of seven ecological Ellenberg indicators.

Light indicator values for Asteraceae species occurring in Garrigue and Subapline/Alpine vegetation were higher than those found in other vegetations types with a mean value of L = 8. The lowest mean light value was observed in species occurring in Beech forests with mean light value of L = 6. The species found in other types of vegetations such as Arable, Riparian, Uncultivated land, Oak forests had moderate requirements for light with mean values of L = 7.7, L = 7.2, L = 7, L = 6.5, respectively.

Temperature indicator mean values in species grown in Riparian and Uncultivated land vegetation ranged from T = 4.5 to T = 6.5, respectively. In other types of vegetations Asteraceae species did not show a significant variation in average values for light indicators such as Beech forests (T = 5.5), Garrigue (T = 5.6), Oak forests (T = 6), Subpalpine/Alpine (T = 6.1), Arable land (T = 6.2) vegetation types.

Continentality mean values ranged from 2.7 to 5.4 to species grown in Riparian and Garrigue vegetations, respectively. Mean EIVs for moisture indicator revealed that species occurring in these types of vegetation prefer dry to medium moisture soils. Uncultivated land vegetation had the lowest mean moisture value (F = 3.2), while Subalpine/Apline (F = 3.3), Garrigue (F = 3.4), Beech forests (F = 3.5), Arable land (F = 4) and Oak forests (F = 4.2) vegetation had similar values. The highest mean moisture value was observed in species found in Riparian vegetation (F = 5.5).

Soil reaction mean values in of Asteraceae species grown in different vegetation types ranged from acidophytic to mildly acidopytic in Uncultivated land (R = 3), Arable land (R = 5.2), Beech forest (R = 6), Riparian (R = 6.5), and Subapline/Alpine (R = 6.6) vegetation to neutral in species grown in Oak (R = 7) and Garrigue (R = 7.4) vegetation.

Mean values of nutrient indicator of Asteraceae species calculated based on their occurrence in analyzed vegetation types revealed that they prefer nutrient poor sites to moderately nutrient-rich sites in Beech forests (N = 4), Garrigue (N = 4.2), Uncultivated land (N = 4.5), Subalpine/Apline (N = 5) and Arable land (N = 6.2) vegetation to nutrient rich sites in Riparian vegetation (N = 7).

IV. CONCLUSIONS

In the Trebeshina Mt. there were found in total 40 species which reflects the high degree of diversity within Asteraceae family in this area. The majority of species had perennial life cycle. A significant number of species were of great importance considering their endemism and their economic value as medicinal plants. EIVs estimations showed a wide range, nevertheless the majority of species of Asteraceae family from Trebeshina Mt. showed preferences for semi-shade, moderate temperatures, weakly oceanic to indifferent continentality indices, the majority of species also showed no tolerance to weak tolerance to salinity, neutral to mildly acidophil and average to moderate nutrient rich soils. The data obtained in this study provide a baseline database for Asteraceae flora composition in Trebeshina Mt. as part of highly important mount range in the South of Albania. The dataset of Ellenberg's values for each species of Asteraceae was provided for the first time in this study. Furthermore, this database and data would contribute to efficient future conservation programs of these species, especially those classified as endangered.

REFERENCES

[1] Khan W., Khan M.S., Ahmad H., Alqarawi A.A., Shah G.M, Hussain M, Abd Allah E.F. 2018. Life forms, leaf size spectra, regeneration capacity and diversity of plant species grown in Thandianu forest, district Abbottabad, Khyber Pakhtunkhwa Pakistan. Saudi Journal of Biological Sciences, 25(1), 94-100.

[2] Simic N., Palic R., Vajs V., Milosavljevic S., Djokovic D. 2000. Composition and Antibacterial Activity of Achillea chrysocoma Essential Oil, Journal of Essential Oil Research, 12 (6), 784-787, DOI: 10.1080/10412905.2000.9712215.
[3] Vangjeli J., Mullaj A., Ruci B., Qosja XH. 1996. Flora of Albania, 4, Pg 502.
[4] IUCN 2016. The IUCN Red List of Threatened Species. *Version 2016-3*. http://www.iucnredlist.org
[5] Saeidnia S., Gohari A.R., Mokhber-Dezfuli N., Kiuchi F. 2011. A review on phytochemistry and medicinal properties of the genus Achillea. DARU, 19 (3), 173-185
[6] Jafarinia M., Jafarinia M. 2019. A review of medicinal properties of some Asteraceae family plants on immune system. Report of Health Care Journal, 5 (2), 1-7.
[7] Koc S., Isgor B.S., Isgor Y.G., Shomali Moghaddam N., Yildirim O. 2014. The potential medicinal value of plants from Asteraceae family with antioxidant defense enzymes as biological targets. Pharm Biol 53 (5):746-51. doi: 10.3109/13880209.2014.942788.
[8] Vangjeli, J. 2015. Excursion Flora of Albania. Hardcover, Koeltz Scientific Books, Konigstein/Germany, ISBN 978-3-87429-477-5, 661.
[9] Raunkiaer C., 1934. The life forms of plants and statistical Geography. Claredon, Oxford.
[10] Funk, V.A., Bayer, R.J., Keeley, S., Chan, R., Watson, L., Gemeinholzer, B., Schilling, E., Panero, J.L., Baldwin, B.G., Garcia-Jacas, N., Susanna, A. & Jansen, R.K. 2005. Everywhere but Antarctica: Using a super tree to understand the diversity and distribution of the Compositae. Biol. Skr. 55: 343-374. ISSN 0366-3612. ISBN 87-7304-304-4.
[11] Peci Dh., Mullaj A., Proko A. 2020. Endemic and Subendemic plant species in Mt. Trebeshina in Southern Albania; Their status and threats. Proceeding of International symposium of Environment Science and Engineering Research, Manisa, Turkey. ISBN 978-605-83522-2-3
[12] Ellenberg, H. 1974. Zeigerwerte der Gef€aßpflanzen Mitteleuropas/ Indicator values of plants in Central Europe. Scripta Geobotanica 9: 1–97. Ellenberg, H. 1979. Zeigerwerte der Gef€aßpflanzen Mitteleuropas. 2. Auflage. Scripta Geobotanica 9: 1–122.
[13] Ellenberg, H., Weber, H.E., Dull, R., Wirth, V., Werner, W. & € Paulißen, D. 1991. Zeigerwerte von Pflanzen in Mitteleuropa/ indicator Values of Plants in Central Europe 1st edition. Scripta Geobotanica 18: 1–248.
[14] Ellenberg, H., Weber, H.E., Dull, R., Wirth, V., Werner, W. & € Paulißen, D. 1992. Zeigerwerte von Pflanzen in Mitteleuropa. 2. verbesserte und erweiterte Auflage/ indicator Values of Plants in Central Europe 2nd edition. Scripta Geobotanica 18: 1–258.
[15] Berg Ch., Welk E., Jager JE. 2017. Revising Ellenberg's indicator values for continentality based on global vascular plant species distribution. Applied Vegetation Science Doi: 10.1111/avsc.12306
[16] Chytrý M., Tichý L., Dřevojan P., Sádlo J. & Zeleny D. (2018): Ellenberg-type indicator values for the Czech flora. – Preslia 90: 83–103.Domina G., Galasso G., Bartolucci F., Guarino R. 2018. Ellenberg Indicator Values for the vascular flora alien to Italy. Flora Mediterranea. 28: 53-61. ISSN: 1120-4052

AUTHOR'S PROFILE

First Author
Dhimiter Peci, Botanists at Research Center of Flora and Fauna, Faculty of Natural Sciences, Tirana, Albania. His research interests are focused on studying of flora and vegetation.

Second Author
Prof. Dr. Alfred Mullaj, Botanists at Research Center of Flora and Fauna, Faculty of Natural Sciences, Tirana, Albania.

Third Author
Prof. Dr. Arsen Proko, Lector and Researcher in Plant Phytosociology, Systematics and Botanic, Biodiversity and Nature Conservation, Faculty of Forestry, Agricultural University, Tirana, Albania.